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(54) Title: DEVICE AND METHOD FOR AUTOMATIC IDENTIFICATION OF SOUND PATTERNS MADE BY ANIMALS

(57) Abstract

A device (100) for automatically identifying sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular. The device stores, analyses, processes data related to the identified sound patterns and deviations therefrom, and provides an attendant with respective alert signals and data according to pre–programmed requirements. The device (100) includes an audio interface (114) for receiving animal sounds, placed in proximity to an animal or group of animals, a storage unit (108), which contains pre–programmed animal sound patterns, connected to a controller (106), and a communication interface (112), also connected to the controller (106) for communicating to a remote unit (142, 140) when the animal sounds received closely match those which have been pre–stored.
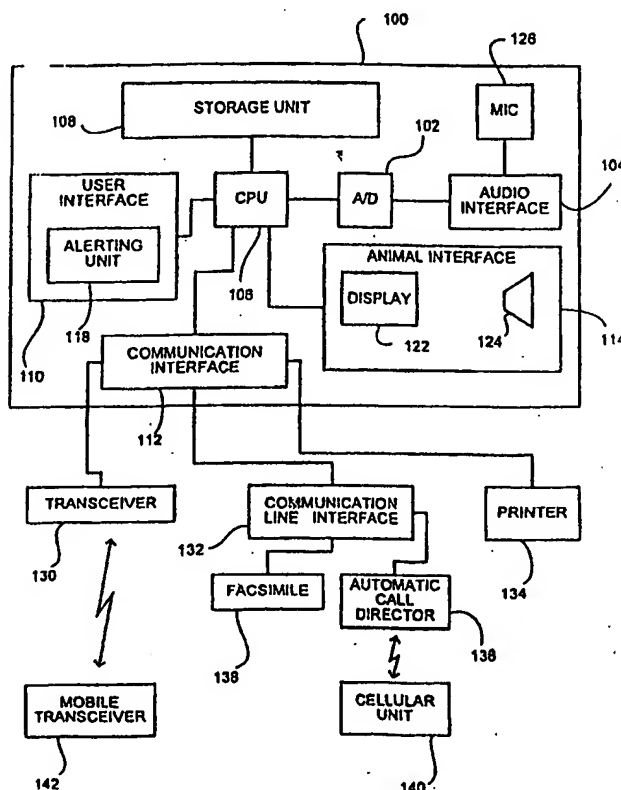
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DEVICE AND METHOD FOR AUTOMATIC IDENTIFICATION
OF SOUND PATTERNS MADE BY ANIMALS

FIELD OF THE INVENTION

The present invention relates to a method and a device for automatically identifying sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor, for storing, analyzing and processing data related to said identified sound patterns and deviations therefrom, and for providing an attendant with respective alert signals and data, according to pre-programmed requirements.

BACKGROUND OF THE INVENTION

In general, certain physiological processes and activities of animals, e.g. cardiac, respiratory, digestive or ruminative processes and activities, are accompanied with distinctive sound patterns indicative thereof. Particularly, an animal or a group of animals while in distress, e.g. presence of a predator, fire, lack of water or food, and especially a pregnant animal going into labor, utter distinctive sound patterns indicative thereof. Automatically identifying said sound patterns and alerting an attendant to provide the required assistance, can be most advantageous.

For instance, it is widely known that many calves die during birth. In extreme cases the mother may also die during labor. It may be noted that on the average, 5%-10% of new born calves die during birth. Death of a calf, especially of livestock, is a significant money loss to the farmer, due to the relatively high price of calves. During 1997 in Israel alone, some 7,400 calves died during birth, 4,100 of which were males and 2,300 were females. A newborn calf is valued at NIS 1,100.- and the income generated by a cow during its life span is valued at NIS 25,000.-.

It is well established in the art, that the presence of an attendant assisting the mother during birth, reduces significantly the rate of mortality of the newborns. The exact time of birth cannot be predicted with any accuracy, hence, the presence of an attendant for assisting the animal during delivery cannot be ensured. Furthermore, the presence of an attendant during regular working hours, provides only a partial solution to the problem. But, as the attendant cannot be in the proximity of the pre-parturient animal during all hours of the day, in particular during the "quiet hours", i.e. late evening, night and the small hours, when most births occur, the beginning of parturition should be automatically identified and alert signal given to an attendant.

Further, distinctive sound patterns accompanying cardiac and respiratory activities and deviations therefrom, may be indicative of other distress conditions of an animal, such as heat stroke, diarrhea, swollen belly, etc. For instance, distinctive sound patterns accompanying disturbances in swallowing (dysphagia), in digestion (dyspepsia), in cardiac or respiratory activities, are indicative of a horse in distress. Also, dogs and cats while in distress, experience cardiac or respiratory changes accompanied by distinctive sound patterns. According to the present invention, all said sound patterns are identified and compared to pre-stored sound patterns, thereby alerting an attendant who may not be in proximity to an animal or a group of animals requiring urgent assistance. The same holds true for birds and fowl which utter distinctive sound patterns when in distress, such as rise in body temperature, lack of water, etc. Thus, all said distress situations should be automatically identified and alert signal given to an attendant.

Sound patterns of an animal, can be received by mounting an audio receiving device on an animal or under its skin or in proximity to an animal or a group of animals, whereby the device according to the present invention identifies sound patterns of a single animal or of a group of animals.

Furthermore, said identified distinctive sound patterns, and deviations therefrom, may be stored, analyzed and processed, thus provide valuable data of the state of an animal or a group of animals, according to pre-programmed requirements. By receiving, identifying, storing, analyzing and processing said sound patterns, an attendant is provided with data according to pre-programmed requirements, whereby he can learn about the physiological processes and activities and behavior of an animal or a group of animals. For example, in livestock, when said data shows deviation from normal digestive sound patterns, an attendant may learn about possible constipation or diarrhea in an animal. Further, when said data shows deviation from the normal of the rate of ruminative process, an attendant can learn about possible problems related to the food quality. Yet further, when said data shows above normal cardiac activity in conjunction with various other deviations from the normal of physiological activities in livestock, an attendant can discover the causes for said deviation of cardiac activity, such as rise in the surrounding temperatures or rise in body temperature indicative of a disease, etc.

Furthermore, according to the present invention, a combination of identified sound patterns related to an increase in cardiac and respiratory rate and identified distinctive sound patterns uttered by a cow going into labor, indicate an approaching delivery.

US Patent no. 4,707,685 to Carrier et al, is directed to a device for detecting the onset of parturition of a pregnant animal. The device is mounted on the animal and detects changes in physical properties which indicate that the animal is going into labor. It will be noted that this device might be activated by accident if, for example, the animal falls or passes under a low horizontal bar or wire.

US Patent no. 4,854,328 to Pollack, is directed to an animal monitoring telltale and information system which utilizes biophysical sensing device such as a temperature sensor, a blood pressure sensor, a blood flow sensor and the like. The system transmits the data received from the biophysical sensing device.

US Patent no. 5,651,070 to Blunt, is directed to a warning device programmable to be sensitive to pre-selected sound frequencies. This device is designed for individuals which are unable to hear warning signals, such as hearing impaired and people working in an environment where warning sounds are hidden by ambient noise. The device detects sounds from devices such as a door bell, a telephone unit, a smoke detector, a security system and the like, compares the frequency of the detected sound with pre-stored frequencies and informs the user.

US Patent no. 5,668,780 to Hsieh, is directed to a baby cry recognizer which detects whether a received sound signal is within a range of pre-stored frequencies.

SUMMARY OF THE PRESENT INVENTION

It is an object of the present invention to provide a novel device for automatically identifying sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor, for storing, analyzing and processing data related to said identified sound patterns and deviations therefrom, and for providing an attendant with respective alert signals and data according to pre-programmed requirements.

It is another object of the present invention to provide a novel method for operating the device of the invention.

It is a further object of the present invention to provide a novel method for providing an attendant with data of said identified sound patterns, and deviations therefrom, according to pre-programmed requirements.

It is yet a further object of the present invention to provide a novel method for providing an attendant with alert signals, once sound patterns of an animal in distress are identified.

In accordance with the present invetnion, there is thus provided a device for automatically identifying said sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor, for storing, analyzing and processing data related to said identified sound patterns, and providing an attendant with respective alert signals and data according to pre-programmed requirements. The device includes an audio receiving device, for receiving sound patterns, placed in proximity to an animal or a group of animals, thereby converting the received sound patterns into an audio signal, a controller, connected to the audio receiving device, a storage unit, containing pre-stored audio patterns, connected to the controller, and a communication interface, connected to the controller, for communicating with a remote communication unit located in proximity to an attendant.

The controller processes the audio signal and compares the processed audio signal with the animal pre-stored audio pattern, thereby producing a likelihood value, representing the degree of resemblance between the audio signal and the pre-stored audio pattern, and stores said likelihood value in the storage unit.

The controller provides a command to the communication interface, to inform the remote communication unit, when the likelihood value exceeds a pre-stored value.

The device can also include a user interface, connected to the controller, for receiving programming instructions from a user, thereby the controller can be pre-programmed to identify various kinds of animal sound patterns and to process, analyze and provide data according to pre-programmed requirements.

The device can further include an animal interface, connected to the controller, for maintaining an open communication line with the animal or group of animals, thereby listening to sounds and voices in proximity thereto and confirming the correctness of the alert signal.

According to another aspect of the invention, the device can also include a GPS unit, connected to the controller, for detecting the position of the device, thereby producing location data. Accordingly, the device provides the location data to the remote communication unit via the communication interface.

According to a further aspect of the invention, the communication interface generates a facsimile transmission and can also be connected to a printer.

According to another aspect of the invention, the communication interface consists of a wireless transceiver and the remote communication unit consists of a mobile transceiver.

The communication interface can transmit an audio message to the remote communication unit and the remote communication unit converts the audio message into sound. The communication interface can also transmit a data message to the remote communication unit and the remote communication unit displays the data message.

The device can further include securing means for securing the device to the animal, such as a collar, an ear securing device, under the skin implant housing, and the like.

The device can further include an analog to digital converter, connected between the audio receiving device and the controller, wherein the analog to digital converter converts the audio signal into digital format, for the controller to collect, analyze and process.

The device can also include an amplifier, connected after the audio receiving device, for amplifying the audio signal.

The device can also include an audio-visual monitoring system for viewing an animal or a group of animals in distress and providing an attendant with alert signals.

In accordance with another aspect of the present invention, there is thus provided a method for identifying said sound patterns accompanying physiological

processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor, for storing, analyzing and processing data related to said identified sound patterns and deviations therefrom, and for providing an attendant with respective alert signals and data, according to pre-programmed requirements, including the steps of:

receiving a sound signal,

converting the sound signal into an audio signal,

comparing the audio signal with animal pre-stored audio pattern,

determining the degree of resemblance between the audio signal and the pre-stored audio pattern, thereby producing a likelihood value,

storing the likelihood value,

initiating an alert procedure when the likelihood value exceeds a pre-stored threshold value, and

providing data according to pre-programmed requirements.

The following is a digital version of the method of the invention which includes the steps of:

receiving a sound signal,

converting the sound signal into an audio signal,

converting the audio signal into digital format, thereby producing a digital audio signal,

comparing the digital audio signal with animal pre-stored audio pattern,

determining the degree resemblance between the digital audio signal and the pre-stored audio pattern, thereby producing a likelihood value,

storing the likelihood value, and

initiating an alert procedure when the likelihood value exceeds a pre-stored threshold value, and

providing data according to pre-programmed requirements.

The method can further include steps such as:

amplifying the audio signal before the step of comparing,

filtering the audio signal after the step of receiving,

filtering the digital audio signal before the step of comparing,

enhancing portions of the digital audio signal before the step of comparing, and

detecting the location coordinates of the animal and transmitting the location coordinates to the remote communication unit, when the likelihood value exceeds a pre-stored threshold value.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

Fig. 1 is a schematic illustration of a device for detecting the delivery of a newborn animal, constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 2 is a schematic illustration of a method for operating the device of Fig. 1, operative in accordance with a preferred embodiment of the present invention;

Fig. 3 is a schematic illustration of a device for detecting the delivery of a newborn animal, and a base station, both constructed and operative in accordance with another preferred embodiment of the present invention; and

Fig. 4 is a schematic illustration of the device of Fig. 3, mounted on a cow.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention overcomes the disadvantages of the prior art by providing a device which identifies sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor.

Reference is now made to Fig. 1, which is a schematic illustration of a device generally referenced 100, constructed and operative in accordance with a preferred embodiment of the present invention.

Device 100 includes a central processing unit (CPU) 106, an analog to digital (A/D) converter 102, an audio interface 104, a microphone 126, a communication interface 112, a user interface 110, an animal interface 114 and a storage unit 108.

CPU 106 is connected to the storage unit 108, the A/D converter 102, the animal interface 114, the communication interface 112 and the user interface 110.

The A/D converter 102 is further connected to the audio interface 104. The communication interface 112 is further connected to a plurality of communication devices such as a transceiver 130 for wireless communication, a printer 134 and a communication line interface 132 for connecting to a facsimile machine 138 and an automatic call director 136. The transceiver 130 is wirelessly linked to a mobile transceiver 142, which is carried by the attendant. The automatic call director 136 is capable of establishing a connection to any telephony destination, which in the present example is a cellular unit 140.

The animal interface 114 includes a display 122. The user interface 110 includes an alerting unit 118, for alerting an attendant which is not present in proximity to the animal in distress. It will be noted that the user interface 110 can also include a multimedia interface (not shown) for receiving instructions from a user, for example, pre-programming it to identify various kinds of animal sound patterns and to provide various data.

The audio interface 104 is basically an amplifier which can be connected to a sound sensitive detector such as the microphone 126. It will be noted that when the signal produced by the microphone is strong enough, then amplification is not necessary. Typically, this microphone 126 is placed in proximity to a delivering animal, or physically mounted thereon or implanted therein or in proximity to a group

of animals. It will further be noted that microphone 126 can be a wireless microphone, wirelessly linked to the audio interface 104.

In the present example, both the A/D converter 102 and the audio interface 104 are implemented in a conventional PC sound card such as the sound-bluster, manufactured and produced by Creative Inc.

The storage unit 108, contains pre-stored sound patterns which were collected by recording a plurality of sound patterns accompanying physiological processes and activities of an animal in general, and uttered by an animal in distress in particular, especially of a pregnant animal going into labor. These sound patterns are used by the device 100, to determine whether a received sound can be regarded as a typical sound accompanying physiological processes and activities of an animal in or uttered by an animal in distress .

The audio interface 104 receives an audio signal from the microphone 126, amplifies it and provides the amplified analog audio signal to the A/D converter 102, which in turn digitizes it, thereby producing a digital audio signal. Then, the A/D converter 102 provides the digital audio signal to the CPU 106.

The CPU 106 accesses the storage unit 108, retrieves the pre-stored sound patterns and compares them to the digital audio signal, received from the A/D converter 102. As a result of the comparison, the CPU 106 produces a likelihood value L as a calculated value of the degree of resemblance between the digital audio signal and the best matching pre-stored sound pattern and stores said L value in the storage unit 108.

When the likelihood value L exceeds a pre-stored threshold P , then, the device executes an alerting procedure in which the alerting unit 118 is activated and the other external communication units are accessed via the communication interface 112 in a plurality of ways as follows:

•⟩ The device 100 provides an alerting message to the transceiver 130 which in turn establishes a wireless communication link with the mobile transceiver 142, preferably carried by the attendant.

•⟩ The device 100 provide an alerting message to the communication line interface 132, which in turn generates a facsimile transmission and transfers it to the facsimile machine 138. The facsimile machine can be located at a control room which goes into action when the attendant cannot be notified.

At the same time, the communication line interface provides a command to the automatic call directing unit 136, to initiate a call to a pre-stored telephony destination, which in the present example is a cellular unit 140, preferably carried by the attendant.

•⟩ The device 100 provide an alerting print message to printer 134, which can be used as a log registry device.

The user interface 110 may be used by the user to retrieve data according to pre-programmed requirements.

Reference is now made to Fig. 2, which is a schematic illustration of a method for operating the device 100 of Fig. 1, operative in accordance with a preferred embodiment of the present invention.

In step 200, the device 100 receives a sound signal via the microphone 102, amplifies it and converts it into digital format (step 202).

In step 204, the CPU 204 processes the digital audio signal and prepares it for further analysis. The preparation consists of filtering procedures and enhancement procedures. The filtering procedures are used to filter out ambient noise and other undesired sounds. The enhancement procedure enhances portions of the digital audio signal, such as the voice of a delivering animal over the voices of nearby animals. At the end of step 206, the CPU 106 produces a digital signal which is a more focused version of the digital audio signal.

In step 206, the CPU 106 analyses the digital signal and identifies animal sound characteristics, such as frequencies, sound pattern, sound envelope, volume and the like.

In step 205, the CPU 106, accesses the storage unit 108 and retrieves the relevant animal pre-stored audio pattern. It will be noted that the storage unit 108 can store sound patterns which relate to various kinds of animals and animal species. Accordingly, for example, since sounds which are typical to a goat are of no relevance when the delivering animal is a cow, only cow related sound pattern is retrieved.

In step 210, the CPU 106 determines the degree of resemblance between the digital signal and the pre-stored audio pattern and produces a likelihood value L.

In step 211, the CPU 106 stores the likelihood value L in the storage unit 108.

In step 212, the CPU 106 detects if the likelihood value L exceeds a pre-stored threshold value which was selected to indicate when an attendant should be alerted. If so, then the CPU 106 initiates an alerting procedure, which can be selected from the above devices such as the alerting unit 118, the mobile transceiver 142, the printer 134 or any combination thereof.

It will be noted that each of the alerting messages can also include data which indicates the identifying device and the identified animal, when the device is attached thereto.

It will be appreciated that when dealing with a group of animals, it is also important to know the location of the identified animal in distress. In accordance with another aspect of the present invention, there is further provided a device which also detects and provides the location of the animal in distress.

Reference is now made to Fig. 3, which is a schematic illustration of a device for identifying an animal in distress, generally referenced 300, and a base station, generally referenced 320, both constructed and operative in accordance with another preferred embodiment of the present invention.

Device 300 includes a CPU 306, an A/D converter 302, an audio interface 304, a microphone 316, a storage unit 108, a global positioning system (GPS) unit 314 and a wireless transceiver 310. The CPU 306 is connected to the A/D converter 302, the global positioning system (GPS) unit 314, the storage unit 108 and a wireless transceiver 310. The audio interface 304 is connected to A/D converter 302 and to the microphone 316.

The base station 320 includes a wireless transceiver 324, a controller 322 and an automatic call directing unit 326. The controller 322 is connected to the wireless transceiver 324 and to the automatic call directing unit 326.

The microphone 316 receives sounds, converts them into audio signal and provides the audio signal to the audio interface 304, which in turn amplifies it and provides the amplified signal to the A/D converter 302.

The A/D converter 302 converts the audio signal into digital format and provides the digitized signal to the CPU 306, which in turn, analyses and compares it with the pre-stored sound patterns stored in the storage unit 108. When the CPU determines that the attendant has to be alerted, then it activates the GPS unit 314. The GPS unit 314 detects the actual position of the identifying device, and hence the approximate location of the animal in distress.

Then, the CPU 306 provides a message including the distress indication as well as the position data, to the base station via the transceiver 310.

The transceiver 324, at the base station 320, receives the message and provides it to the controller 322, which in turn activates the automatic call director 326. In the present example, the automatic call director 326 establishes a communication link with a cellular unit 330, preferably carried by the attendant.

It will be noted that the message received at the cellular unit 330, can include data, which is displayed on the screen of the mobile unit, or an audio alert, which describes the detected situation of the animal as well as verbal description of its position.

Reference is now made to Fig. 4, which is a schematic illustration of the device of Fig. 3, mounted on a cow. Device 300 is secured to a cow 370 with a neck collar 350. The device 300 is linked to the base station 320, via a wireless link 360.

It will be noted that the device 300 can be secured to the animal in many ways, depending on the anatomy of the animal. For example, the device 300 can be secured to the ear or back of the animal. Furthermore, device 300 can be fit into an internal housing which is inserted under the skin of the animal.

Reference is now made to Fig. 5, which is a schematic illustration of the system for monitoring the audio-visual condition of an animal or a group of animals, generally referenced 400, constructed and operative in accordance with another preferred embodiment of the present invention.

System 400 includes a CPU 406, a storage unit 402, a communication interface 410, an audio interface 408, a video interface 404 and a camera movement controller 418.

The CPU 406 is connected to the storage unit 402, the communication interface 410, the audio interface 408, the video interface 404 and the camera movement controller 418.

System 400 is generally located in proximity to an animal or a group of animals and monitors the sounds which they produce by utilizing a plurality of microphones 412A, 412B and 412C, all of which are connected to and controlled by the audio interface 408.

System 400 also monitors the movements and general behavior of the animals by utilizing a plurality of video cameras 414A and 414B, all connected to the video interface 404.

In the present example, each of the cameras 414A and 414B is mounted on a motorized basis, 416A and 416B, respectively, which is operable to point its associated camera to various directions. Each motorized basis, 416A and 416B, is connected to and controlled by the camera movement controller 418.

Each of the video cameras 414A and 414B provides video signals to the video interface 404. The video interface 404 can store or record the video signals. The video interface 404 can also control some optical properties of the cameras such as focal length, zoom angle, aperture setting, shutter speed and the like. It will be noted that these properties can also be controlled automatically by the camera.

Each of the microphones converts received sounds into an audio signal and provides this audio signal to the audio interface 408. The audio interface 408, converts the audio signals into respective digital audio signals and provides them to the CPU 406. The CPU 404 analyzes digital audio signals and compares their patterns with audio patterns which were pre-stored in storage unit 402. When a reliable match is detected, then the CPU 406 provides a command to the communication interface to connect to a pre-stored remote address, which can be a telephone line, an IP address, a cellular unit and the like.

The supervisor which is located at that remote address, communicates with the system 400, thereby receiving information related to the identified pattern, the time of identification, the identity of the receiving microphone through which the identified pattern was received and the like.

The supervisor can also receive a video signal which is detected by either of cameras 414A and 414B. If desired, the supervisor can provide system 400 with a command to direct the cameras to various directions. Such a command is received in the CPU 406, via the communication interface 410. Then, the CPU 406 provides this command to the camera movement controller 418, which in turn provides it to the respective camera.

It will be noted that system 400 can also initiate a camera movement automatically. In this case, when a received digital audio signal is found to be matching a pre-stored sound pattern, then the CPU 406 determines the location of the receiving microphone, produces a camera movement command and provides it to the

camera movement controller 418, which in turn activates the respective motorized basis.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow.

CLAIMS

1. A device for automatically identifying animal sound patterns and providing an attendant with respective alert signals, the device comprising:

    an audio receiving device, for receiving sound patterns in proximity to said animal, thereby converting said sound patterns into an audio signal;

    a controller, connected to said audio receiving device;

    a storage unit, containing pre-stored audio patterns, connected to said controller; and

    a communication interface, connected to said controller, for communicating with a remote communication unit located in proximity to said attendant,

    wherein said controller processes said audio signal and compares it with said pre-stored audio pattern, thereby producing a likelihood value, representing the degree of resemblance between said audio signal and said pre-stored audio pattern,

    wherein said controller provides a command to said communication interface, to inform said remote communication unit, when the likelihood value exceeds a pre-stored value.

2. The device according to claim 1, wherein said controller stores said likelihood value and provides data to said attendant according to pre-programmed requirements.

3. The device according to claim 1, further comprising a user interface, connected to said controller, for receiving programming instructions from a user.

4. The device according to claim 1, further comprising an animal interface, connected to said controller, for maintaining an open communication line with said animal, thereby listening to sounds in proximity thereto and confirming the correctness said controller command to said communication interface.

5. The device according to claim 1, further comprising a GPS unit, connected to said controller, for detecting the position of said device, thereby producing location data,

    wherein said device provides said location data to said remote communication unit via said communication interface.

6   The device according to claim 1, wherein said communication interface generates a facsimile transmission.

7. The device according to claim 1, wherein said communication interface is further connected to a printer.

8. The device according to claim 1, wherein said communication interface consists of a wireless transceiver and wherein said remote communication unit consists of a mobile transceiver.

9. The device according to claim 1, wherein said communication interface transmits an audio message to said remote communication unit and said remote communication unit converts said audio message into sound.

10. The device according to claim 1, wherein said communication interface transmits a data message to said remote communication unit and said remote communication unit displays said data message.

11. The device according to claim 1, wherein said device further includes securing means for securing said device to said animal.

12. The device according to claim 11, wherein securing means is selected from the list consisting of:

      a collar;

      a back securing assembly;

      an ear securing device; and

      an internal housing.

13. The device according to claim 1, further comprising an analog to digital converter, connected between said audio receiving device and said controller,

      wherein said analog to digital converter converts said audio signal into digital format, for said controller to process.

14. The device according to claim 1, further comprising an amplifier, connected after said audio receiving device, for amplifying said audio signal.

15. The device according to claim 1, wherein pre-stored audio patterns are related to animal sound patterns accompanying cardiac, respiratory, digestive, ruminative processes and activities and uttered by animal in distress.

16. Method for automatically identifying animal sound patterns and providing an attendant with respective alert signals, comprising the steps of:

      receiving sound signal;

      converting said sound signal into an audio signal;

      comparing said audio signal with animal pre-stored audio pattern;

determining the degree of resemblance between said audio signal and said

pre-stored audio pattern, thereby producing a likelihood value; and

Initiating an alert procedure when said likelihood value exceeds a

pre-stored threshold value.

17.   Method for automatically identifying animal sound patterns and providing an

attendant with respective alert signals, comprising the steps of:

receiving sound signal;

converting said sound signal into an audio signal;

converting said audio signal into digital format, thereby producing a digital

audio signal;

comparing said digital audio signal with animal pre-stored audio pattern;

determining the degree of resemblance between said digital audio signal

and said pre-stored audio pattern, thereby producing a likelihood

value; and

Initiating an alert procedure when said likelihood value exceeds a

pre-stored threshold value.

18.   The method according to either of claims 16 and 17, further comprising a step

of storing said likelihood value and providing data to said attendant according to

pre-programmed requirements.

19.   The method according to either of claims 16 - 18, further comprising a step of

amplifying said audio signal before said step of comparing.

20.   The method according to either of claims 16 - 18, further comprising a step of

filtering said audio signal after said step of receiving.

21. The method according to claim 17 and 18, further comprising a step of filtering said digital audio signal before said step of comparing.

22. The method according to claim 17 and 18, further comprising a step of enhancing portions of said digital audio signal before said step of comparing.

23. The method according to either of claims 16 - 18, further comprising a step of detecting the location coordinates of said animal and transmitting said location coordinates to said remote communication unit, when said likelihood value exceeds a pre-stored threshold value.

24. System for automatically identifying animal sound patterns and providing an attendant with respective alert signals, the system comprising:

   a CPU;

   a storage unit, connected to said CPU, for pre-stored sound patterns;

   a communication interface, connected to said CPU, for connecting to a remote address, at the location of said attendant;

   an audio interface; and

   at least one audio sound sensor, said sound sensor receiving sounds patterns and providing said sounds patterns to said audio interface as audio signals,

   said audio interface converting said audio signals into digital audio signals and providing said digital audio signals to said CPU,

   said CPU analyzing said digital audio signals, thereby comparing said sound patterns with said pre-stored sound patterns, and

   said CPU commands said communication interface to connect to said remote address when said CPU detects a match value by comparing said sound patterns to said pre-stored sound patterns.

25.   The system according to claim 24, wherein said CPU stores said detected match value and provides data to said attendant according to pre-programmed requirements.

26.   The system according to claim 24 and 25, further comprising:

       a video interface connected to said CPU; and

       at least one video camera, connected to said video interface, for detecting the movement of said animal.

27.   The system according to claim 24 and 25, further comprising:

       a camera movement controller, and

       at least one motorized basis, connected to said camera movement controller,

       wherein at least a selected one of said at least one video cameras is mounted on a selected one of said at least one motorized basis,

       wherein said selected motorized basis directs said selected video camera.

28.   A device, method and system for automatically identifying animal sound patterns and providing an attendant with respective alert signals and data

according to pre-programmed requirements, substantially comprising any and all features of novelty as described, referred to, exemplified, illustrated or shown, hereinabove or in the accompanying drawings.

1/5
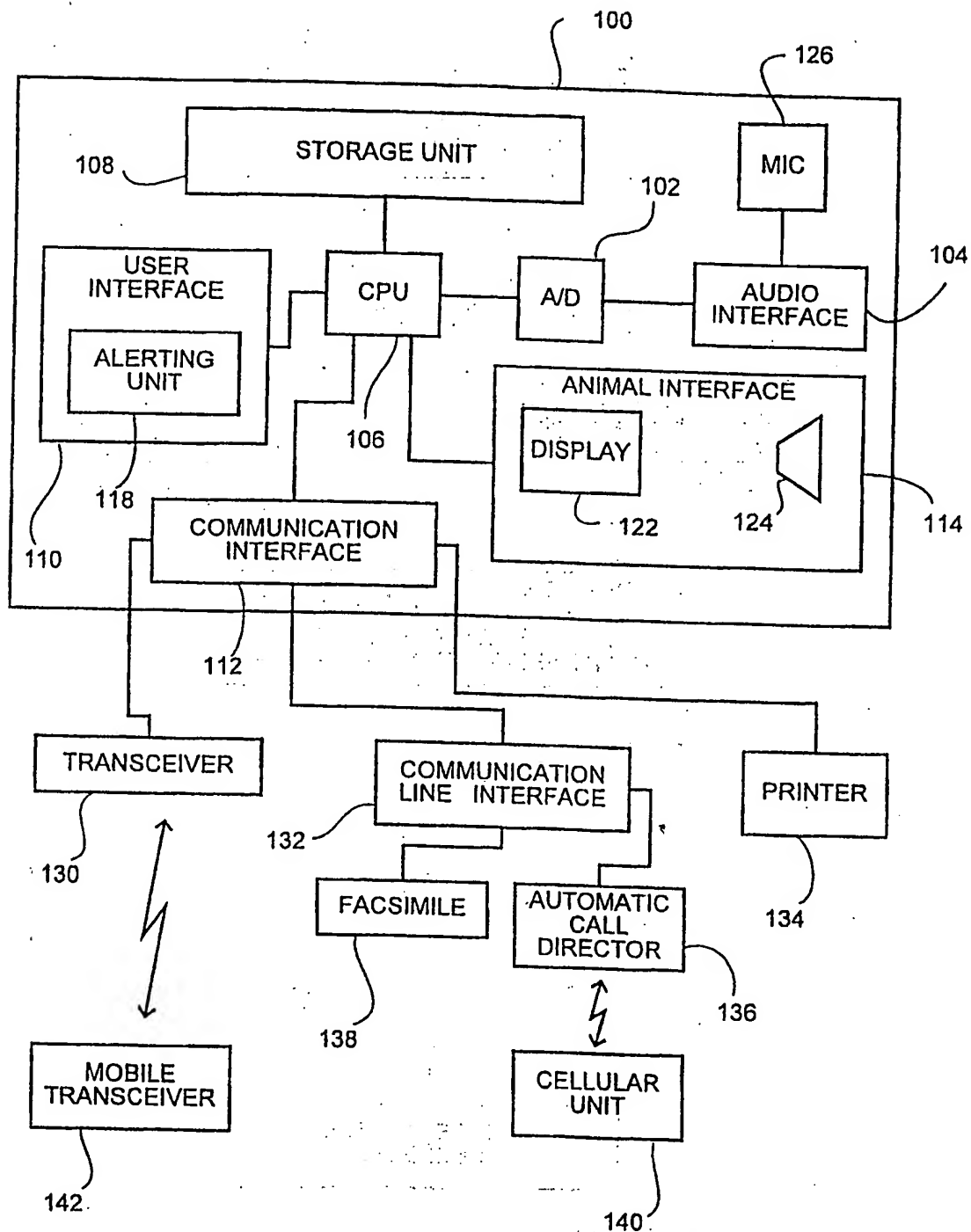
FIG. 1
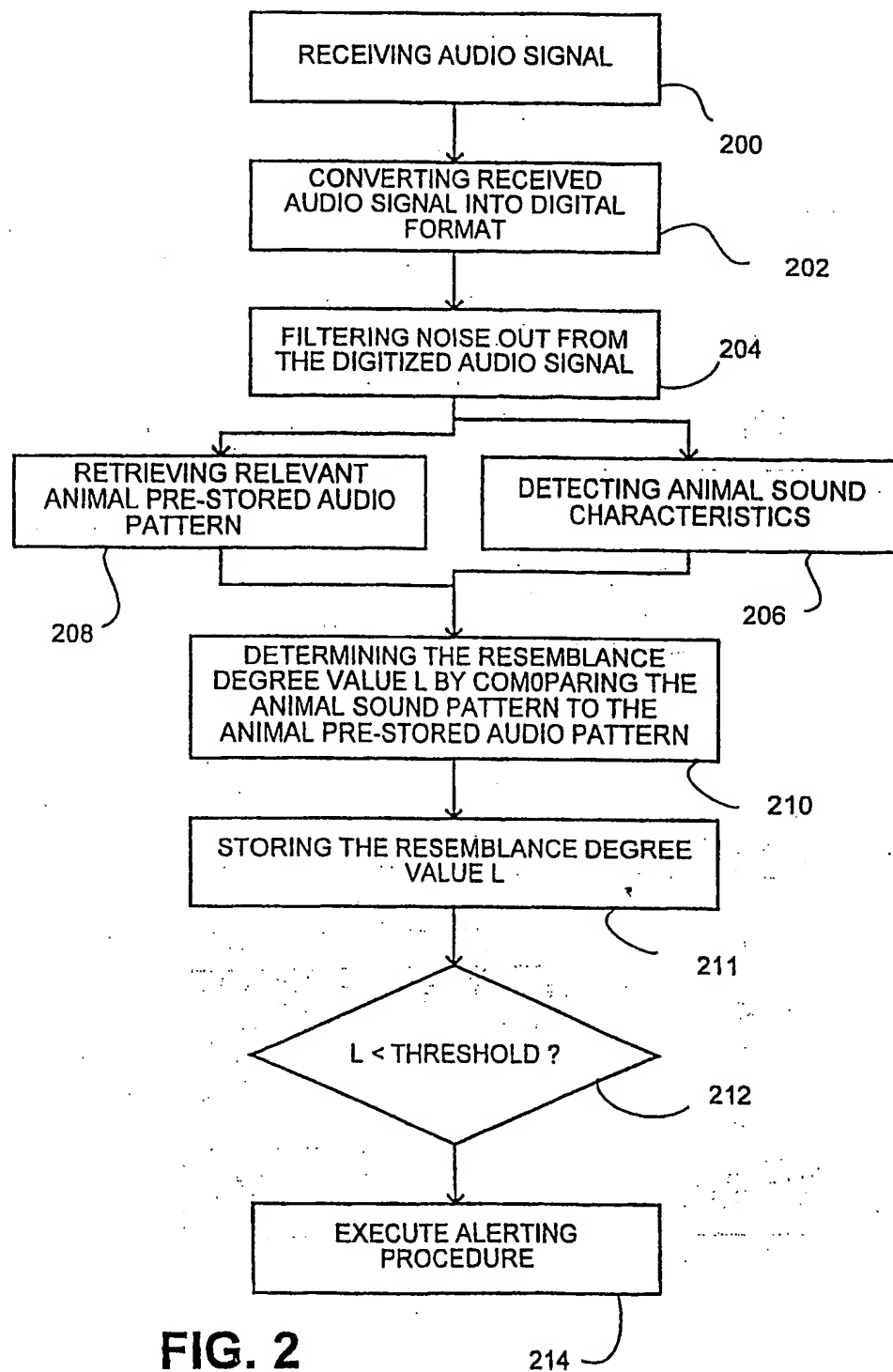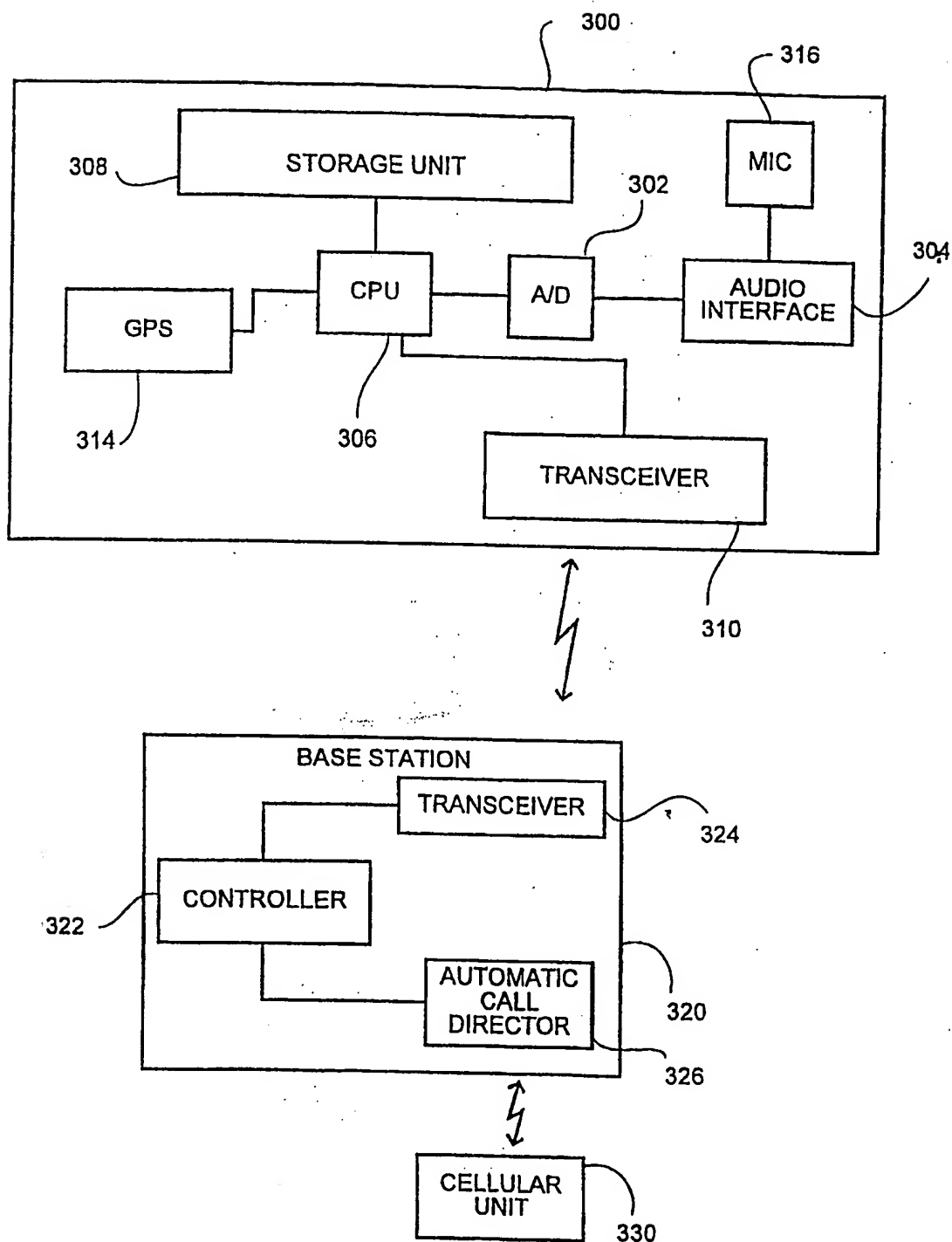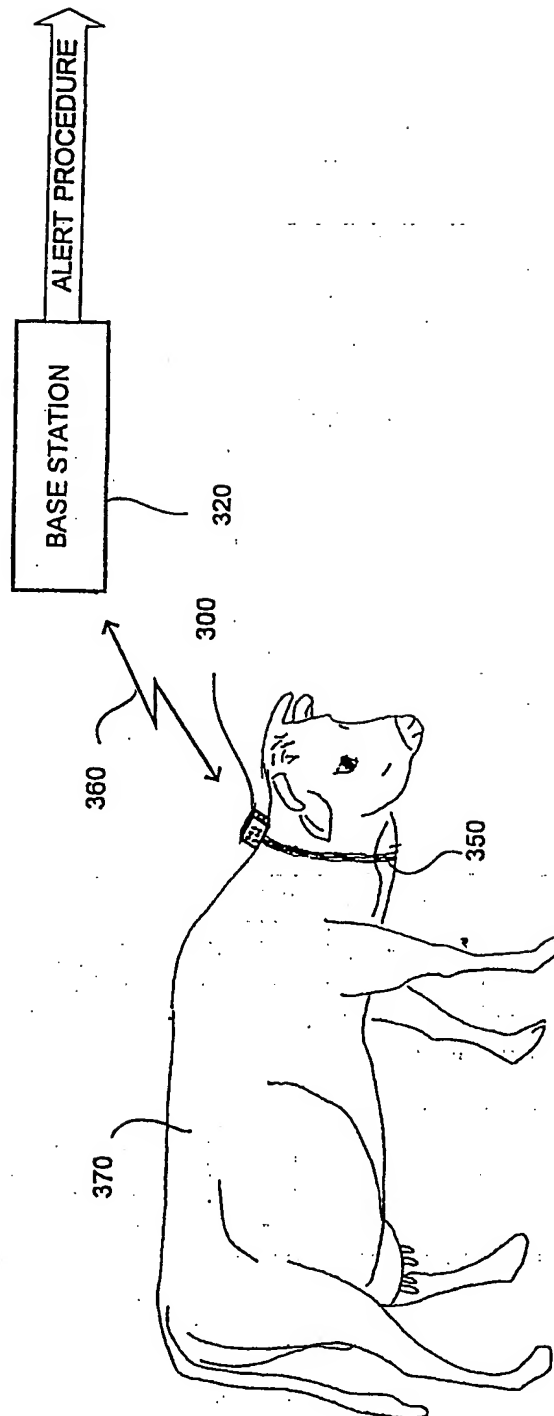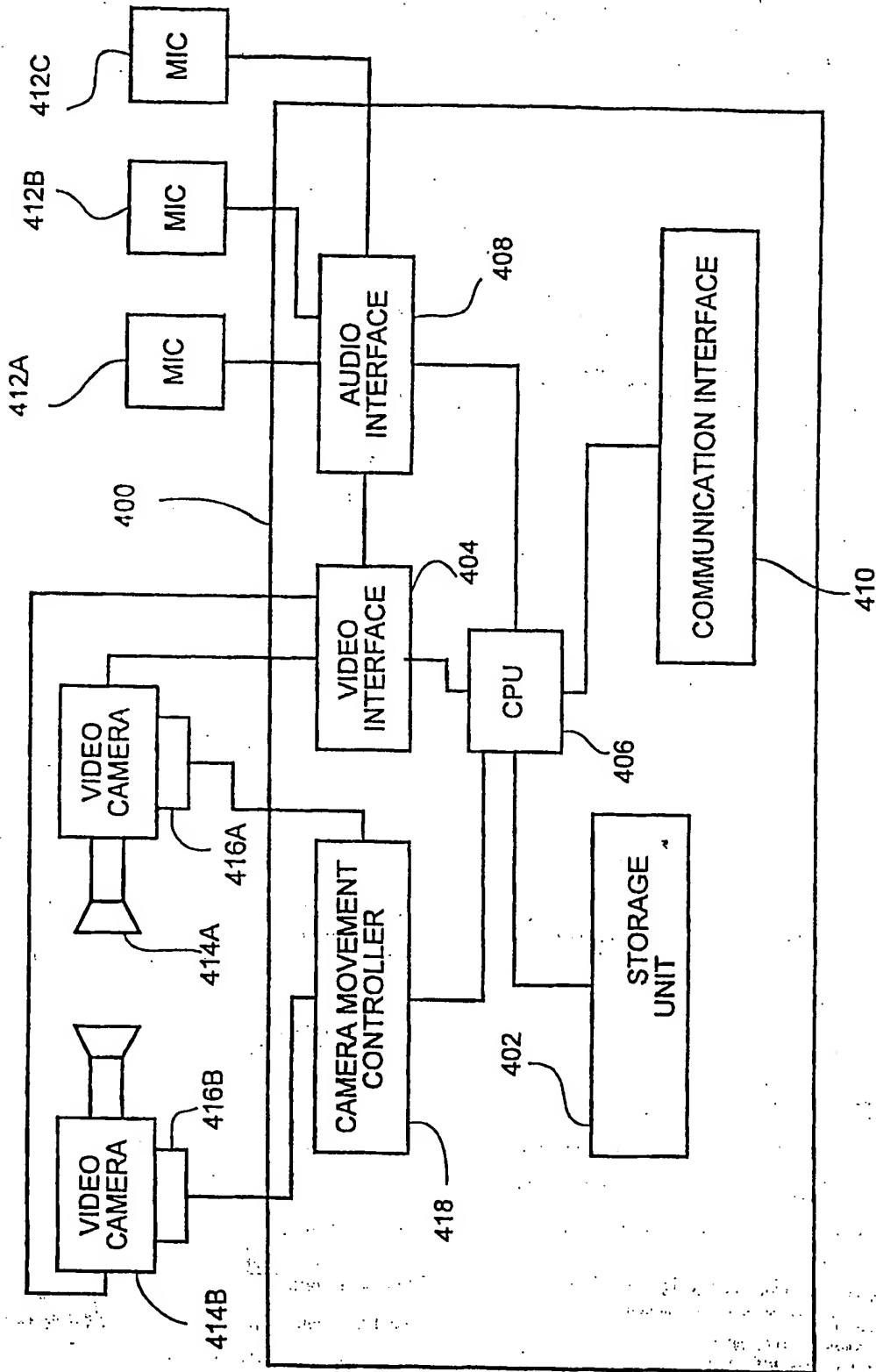
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                    │  RECEIVING AUDIO SIGNAL  │
                    └─────────────┬───────────┘
                                  │              ⤵ 200
                    ┌─────────────▼───────────┐
                    │   CONVERTING RECEIVED   │
                    │  AUDIO SIGNAL INTO DIGITAL│
                    │         FORMAT          │
                    └─────────────┬───────────┘  ⤵ 202
                                  │
                    ┌─────────────▼───────────┐
                    │  FILTERING NOISE OUT FROM│  ⤵ 204
                    │  THE DIGITIZED AUDIO SIGNAL│
                    └──────┬───────────┬──────┘
                           │           │
           ┌───────────────▼──┐    ┌───▼─────────────────┐
           │ RETRIEVING RELEVANT│   │ DETECTING ANIMAL SOUND│
           │ ANIMAL PRE-STORED AUDIO│ │   CHARACTERISTICS    │
           │      PATTERN      │    │                     │
           └─────────┬────────┘    └──────────┬──────────┘
                   ⤵ 208                      ⤵ 206
                     └──────────┬──────────────┘
                    ┌───────────▼─────────────┐
                    │ DETERMINING THE RESEMBLANCE│
                    │ DEGREE VALUE L BY COM0PARING THE│
                    │ ANIMAL SOUND PATTERN TO THE │
                    │ ANIMAL PRE-STORED AUDIO PATTERN│
                    └───────────┬─────────────┘  ⤵ 210
                                │
                    ┌───────────▼─────────────┐
                    │ STORING THE RESEMBLANCE DEGREE│
                    │        VALUE L          │
                    └───────────┬─────────────┘  ⤵ 211
                                │
                          ◇─────▼──────◇
                         ╱  L < THRESHOLD ? ╲
                         ╲               ╱  ⤵ 212
                          ◇─────┬──────◇
                                │
                    ┌───────────▼─────────────┐
                    │   EXECUTE ALERTING      │
                    │      PROCEDURE          │
                    └─────────────────────────┘  ⤵ 214
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FIG. 2

FIG. 3

FIG. 4

FIG. 5

A.   CLASSIFICATION OF SUBJECT MATTER

IPC(6)   :   H04M 1/00, 11/00; G10L 3/00; A01K 1/10
US CL   :   379/88.01, 40; 455/404; 119/51.02, 719, 908; 704/231, 243

According to International Patent Classification (IPC) or to both national classification and IPC

B.   FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 455/403,404; 379/39,40;119/51.02,719-721; 340/573; 704/231, 232, 246

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST; livestock, animal$, recognition or recognize, distress or sound$ or speech

C.   DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 5,901,660 A (STEIN) 11 May 1999, see figure 5a and col.7 line 32 through col.8 line 40	1-4, 6-8, 11-13, 16-17, 24-25,
A,P	US A 5,842,162 A (FINEBERG) 24 November 1998, see col..2 lines 35-40.	1,16-17 and 24
A	US 5,677,675 A (TAYLOR et al) 14 October 1997, see abstract.	1,16-17 and 24

☐   Further documents are listed in the continuation of Box C.   ☐   See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
	06 DEC 1999
Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231	Paul A Loomis *James R. Matthews*
Facsimile No. (703)305-3230	Telephone No. (703) 305-4700

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL99/00452

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claim Nos.: 28
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
   Claim 28 is an omnibus type claim in where it is not possible for the internation search authority to determine the meets and bounds of the claim

3. ☒ Claim Nos.: 18-23 and 26-27
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest   ☐ The additional search fees were accompanied by the applicant's protest.
                          ☐ No protest accompanied the payment of additional search fees.

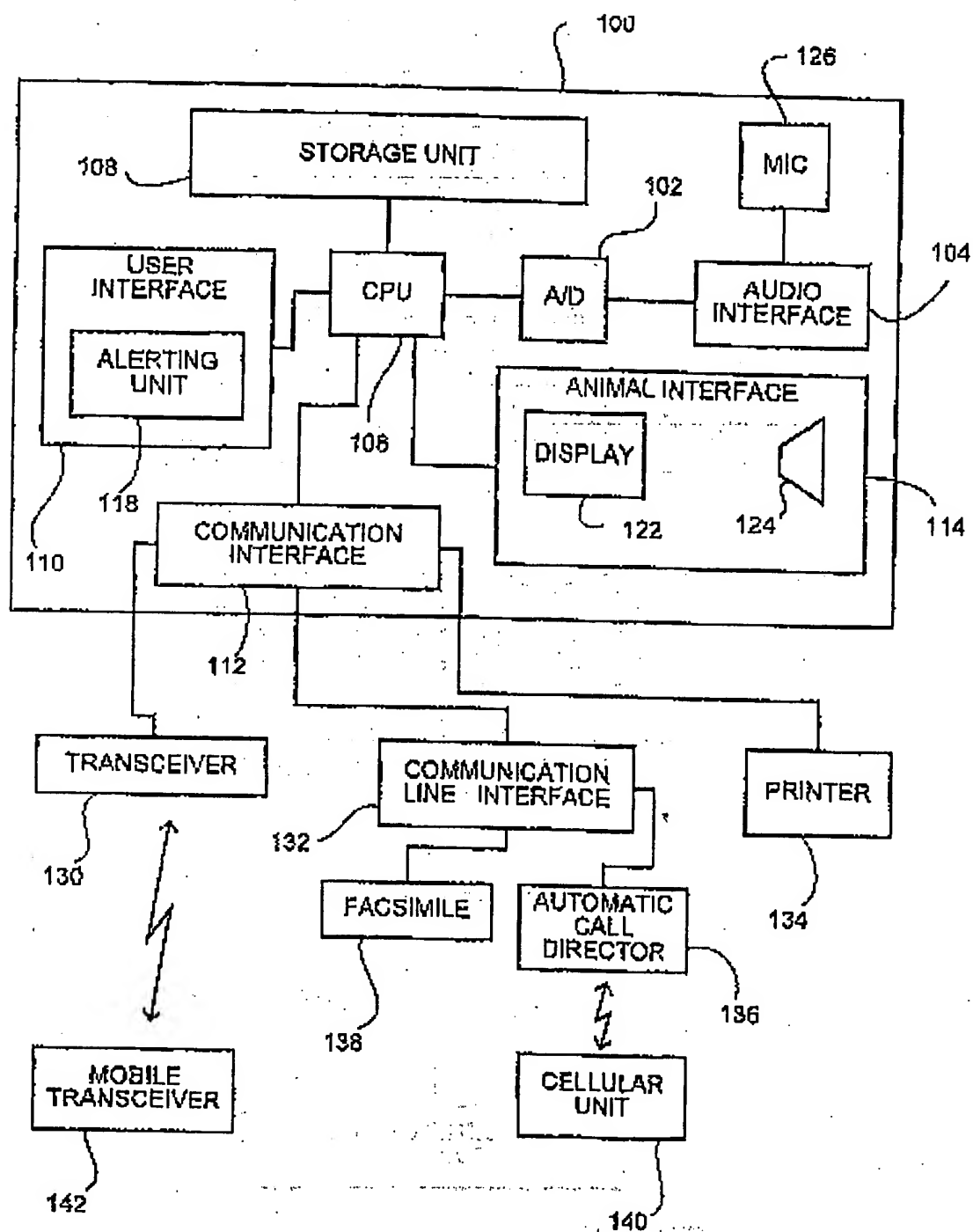Form PCT/ISA/210 (continuation of first sheet(1)) (July 1998)
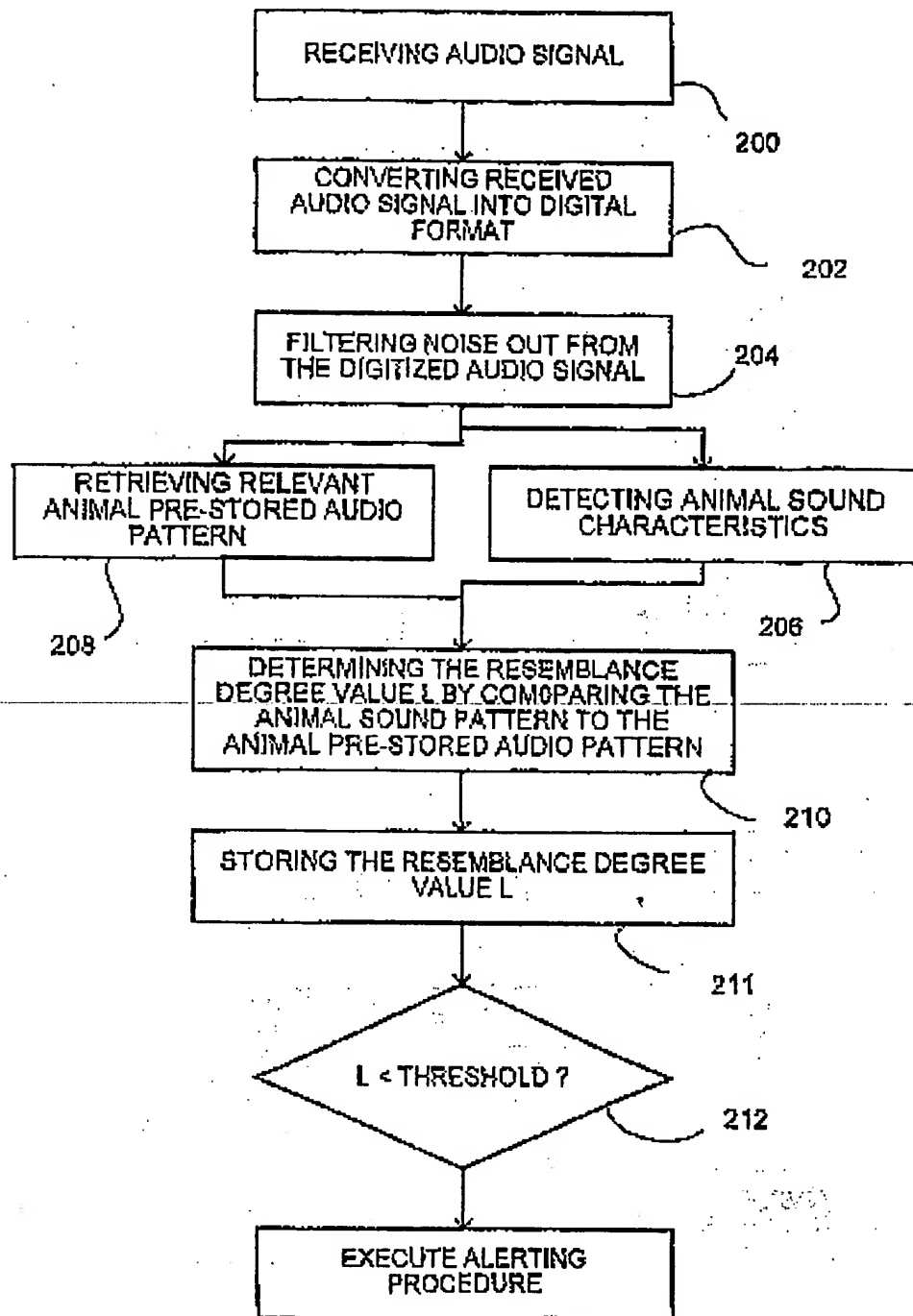
1/5

FIG. 1

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│      RECEIVING AUDIO SIGNAL      │
└─────────────────────────────────┘
                 │                    ⟍ 200
                 ▼
┌─────────────────────────────────┐
│     CONVERTING RECEIVED          │
│   AUDIO SIGNAL INTO DIGITAL      │
│          FORMAT                  │
└─────────────────────────────────┘
                 │                    ⟍ 202
                 ▼
┌─────────────────────────────────┐
│    FILTERING NOISE OUT FROM      │  ⟍ 204
│   THE DIGITIZED AUDIO SIGNAL     │
└─────────────────────────────────┘
         │                  │
         ▼                  ▼
┌──────────────────┐  ┌──────────────────┐
│ RETRIEVING RELEVANT│ │ DETECTING ANIMAL SOUND│
│ ANIMAL PRE-STORED  │ │  CHARACTERISTICS      │
│     PATTERN        │ │                       │
└──────────────────┘  └──────────────────┘
      208                      206
         │                  │
         ▼                  ▼
┌─────────────────────────────────┐
│   DETERMINING THE RESEMBLANCE    │
│ DEGREE VALUE L BY COMOPARING THE │
│    ANIMAL SOUND PATTERN TO THE   │
│   ANIMAL PRE-STORED AUDIO PATTERN│
└─────────────────────────────────┘
                 │                    ⟍ 210
                 ▼
┌─────────────────────────────────┐
│   STORING THE RESEMBLANCE DEGREE │
│            VALUE L               │
└─────────────────────────────────┘
                 │                    ⟍ 211
                 ▼
           ◇─────────────◇
          ╱   L < THRESHOLD ? ╲        ⟍ 212
           ◇─────────────◇
                 │
                 ▼
┌─────────────────────────────────┐
│       EXECUTE ALERTING           │
│         PROCEDURE                │
└─────────────────────────────────┘
                          214
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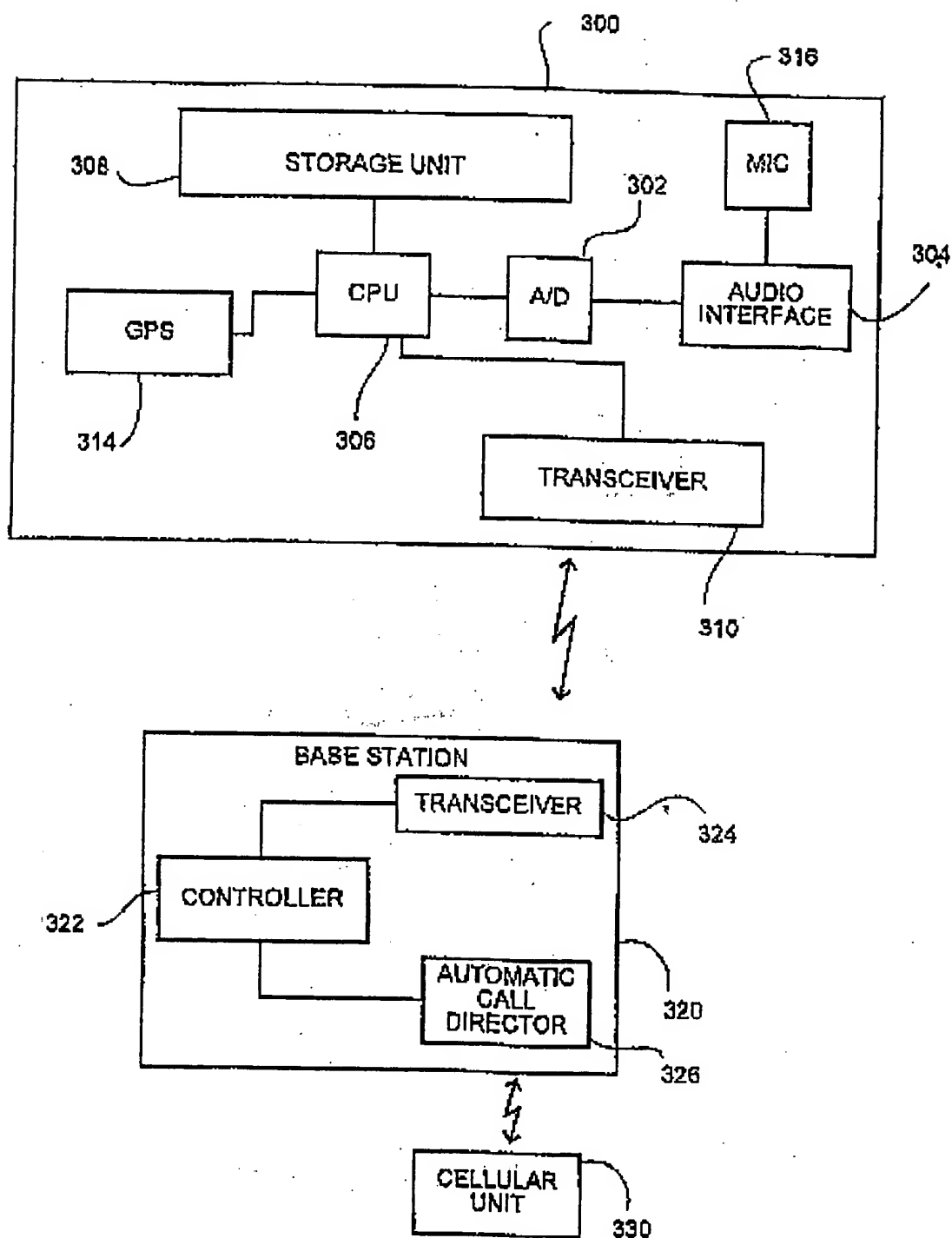
FIG. 2

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FIG. 3

FIG. 4

FIG. 5